Part I
General Principles and Methods

1. Introduction

The study of the microscopic details of the structure of plants usually requires some preparation of the material to facilitate observation. Unicellular, filamentous, or other minute plants require comparatively little preparation. The material may simply be mounted on a slide in a drop of water and thus studied, even under considerable magnification. Larger plants, or parts of plants, must be dissected or cut into thin slices in order to expose inner regions and to permit light to penetrate through the object. Some materials have enough natural coloration to be visible even when finely divided or sectioned. Highly transparent or colorless structures, on the other hand, must be made visible by the use of stains. Preparations that are to receive considerable handling over a period of time should have some degree of permanence. The desirable properties of microscopic preparations are, therefore, adequate thinness, coloration or refractile visibility, and permanence.

The processes used in the preparation of plant materials for microscopic study can be roughly classified in the following categories:

1. Unicellular, filamentous, and thin thalloid forms can be processed *in toto* – without sectioning – and mounted as "whole mounts" to make temporary or permanent slides.

2. Some succulent tissues can be crushed or smeared into a thin layer on a slide or cover glass. The preparation is then stained and treated to make temporary or permanent slides.

3. The more complex and massive tissues are usually sliced into very thin slices, freehand or with a microtome. Materials that are not sufficiently rigid to be cut without support are embedded in a supporting matrix before sectioning. The sections are stained and mounted to make temporary or permanent slides.

The method used for the perparation of a given subject depends on the character of the material, the use that is to be made of the

slides, and such facilities as equipment, reagents, and time. The experienced worker does not overstress the merits and applicability of some one method. For example, important advances in smear methods and related processes for the study of nuclear and chromosome details have replaced to some extent embedding and sectioning. The whole-mount method is recognized to be entirely satisfactory for many algae, fern prothalli, and similar subjects. However, microtome sections of embedded material must be made if we wish to study the undisturbed cellular organization of a tissue, the development and arrangement of organs, or the structural relationship between a fungus or insect parasite and the tissues of its host. The much-maligned celloidin method must be used to keep intact a badly decayed, fungus-infected piece of oak railroad tie for an examination of the mycelium in the wood. In order to avoid undue emphasis on any particular method, we should recognize that each of the well-established methods has its proper sphere, in which it is the most effective and economical method of performing a given task.

The sequence in which processes are arranged in this book takes cognizance of the fact that the paraffin method furnishes by far the largest number of slides produced for teaching and research. Certain operations, such as the killing of protoplasm and the preservation of fixation images, are essentially similar for smears, sectioning, and whole-mount methods. The preliminary processing of material is much the same in the several embedding and sectioning methods. In view of these facts, the paraffin method is presented with unbroken continuity of its operations.